

REED (B.)

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**THE RATIO THAT ALIMENTATION SHOULD
BEAR TO OXYGENATION IN DISEASE
OF THE LUNGS.¹**

BY BOARDMAN REED, M.D.,
OF ATLANTIC CITY, N. J.

WITHIN the past two decades much has been heard of super-alimentation and forced feeding in pulmonary tuberculosis. It seems to have been assumed in many quarters that the more food a tuberculous patient can be made to take, the better his chances of recovery. Recent studies and observations have, however, led me to consider seriously whether it is not just as true in diseases of the lungs as it admittedly is in other diseases, that excess of food beyond the amount that can be perfectly digested and assimilated is injurious. It seems even probable that in pulmonary affections the gaseous products of indigestion and imperfect oxidation, being partly excreted by the lungs, may be more deleterious than in other cases.

The title of this paper assumes that there exists a definite ratio between the amount of oxygen that a pulmonary patient takes in and the amount of food that he is capable of digesting and assimilating.

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When the intake of oxygen is large, as occurs in the case of robust persons who are exercising actively in the open air, it is manifest that a maximum amount of food will be demanded and can be safely given. When, on the other hand, a patient has one or even both lungs crippled by disease, leaving him, as often happens, only one-half or one-third his normal breathing-power, and is moreover entirely at rest, being confined to bed in a close, ill-ventilated room, his consumption of oxygen is relatively very small, and the amount of food that he can digest and thoroughly oxidize into a nutritive pabulum for the uses of the economy is very much less.

Between these two extremes are found patients with all possible degrees of capacity and opportunity for absorbing oxygen, and, in consequence, with equally varying degrees of capacity for digesting and assimilating food. If the bedridden patient with only one lung be compelled to ingest even one-half as much food as is imperatively required by the robust outdoor laborer, mischief must result from the surplus that cannot be oxidized into assimilable forms, even if it were possible for it to be digested. Evidently, then, there is such a ratio as has been assumed, and it is exceedingly important that this fact be borne in mind in deciding as to the proper feeding of any case of pulmonary disease.

My attention has of late been particularly directed toward the study of diet and digestion, and, meeting often with such surprisingly good results from carefully-selected and occasionally even severely-restricted diet in numerous forms of disease, it occurred

to me last winter to ascertain what a more careful diet, in connection with a larger allowance of oxygen in the form of pure air, could do for my tuberculous patients. About the time when this resolve was made there came into my hands several new cases of pulmonary tuberculosis, including one in which, on account of the extreme irritability of the stomach, full feeding was out of the question. Following will be found a report of it:

CASE I.—The driver of an express-wagon, thirty years old, was first seen by me January 19, 1894. He had always been strong until some time in August, 1893, when he began to cough severely and to have shortness of breath. He first noticed that he had fever about the first of October, and took to his bed early in November on account of fever and debility. He had previously vomited a good deal, often as much as five times a day. He had remained in bed from the time mentioned till he came under my care. While in bed he had been vomiting several times daily, and particularly after almost every meal. His previous medical attendant was said to have urged very liberal feeding—that the patient be made to take as much as he possibly could. I found the man with a temperature ranging from 101° to 102° in the afternoons and with a pulse usually much above 100. When he had last been able to get out, nearly two months before, he had weighed 112 pounds. I should have estimated his weight at somewhat less at the time of my first visit—probably about 105 pounds. He was then expectorating an abundance of the usual nummular sputum of pulmonary tuberculosis in the second stage, and said that he had been doing so for several weeks. He was having copious night-sweats, and his nights were further disturbed by a frequent harassing cough.

Examination disclosed dulness on percussion at the right apex anteriorly, and a similar condition somewhat less marked posteriorly; increased vocal fremitus and subcrepitant râles over the same regions, with some gurgling râles and cavernous breathing at a point in front a short distance below the clavicle. At the left apex anteriorly there were the usual signs of a slight infiltration.

The man lay in bed, heavily covered, in a close, warm room of very small dimensions and without any ventilation except such as was afforded by a door opening upon a staircase which led to the living-rooms below. The directions now given were that the windows in the room should be opened to the fullest extent possible and kept so constantly during the day, except in very bad weather, and that they should be open at least six inches at night; the patient meanwhile to be covered just sufficiently to be comfortable. To prevent his "taking cold" and to improve his nervous tone, he was to be sponged at first with cool and later on with cold water, every morning. He was allowed small portions of the blandest liquid diet at intervals of two hours, and tablets containing one-tenth of a drop of creosote were administered, one every two hours, to stop the vomiting and improve digestion.

The vomiting ceased at once, and never recurred except once some ten days later as a result of imprudent eating in violation of express rules. After the stomach had regained its tone and the appetite had become voracious, as it did without other medicine, from the effects of the spongings and freer ventilation, I was obliged to impose stringent restrictions to prevent over-eating.

The man was allowed a plain breakfast of beef-steak or chops and bread and butter, preceded an hour before by a glass of hot water in which was dissolved a little table-salt. In the middle of the

day he was directed to take, instead of his accustomed hearty dinner, merely a light lunch of crackers or stale bread and butter, with a baked apple or other fresh fruit, such as grapes or oranges. His supper was much the same as his breakfast, except that either roast or broiled meat or fowl was permitted, with one or two vegetables, but no desserts except fresh fruits. Milk was also permitted.

Pari passu with the gain in gastric tone there was an improvement in the cough, fever, and most of the other symptoms. By the end of two weeks the temperature had ceased to rise above 99.5° in the afternoon; the night-sweats had nearly disappeared and there was no longer any sputum, though still a dry cough. The physical signs showed corresponding improvement. The pulse continued to be weak and rather rapid, and attempts to strengthen it by administering a glycerite of the hypophosphites (Churchill's formula) disturbed his digestion somewhat, and so was abandoned. Minute doses of arsenic iodid were then given with good effect, and at times small doses of creosote were again administered. From the beginning the chest was painted over the affected areas with tincture of iodine every day till the skin became sore; then it was left a few days until new skin formed, when the painting was resumed, and so on.

The man continued to improve in all ways until, at the end of a month from the time the treatment began, he was able to drive out every pleasant day, and was required to sit out or lie on a cot in the front of his house in all weathers except the roughest. Fortunately the winters in Atlantic City are usually very open and mild, the past winter having been exceptionally so, and therefore this patient enjoyed a continual out-door air-bath from morning until night almost every day. By this time his weight had increased to 126 pounds, and there was no

longer any elevation of temperature, except that it occasionally reached 99° at night.

On February 27 the patient began to suffer from a relapse, which I attributed to a lapse on his part from the stringent dietetic rules that had been imposed on him. He had gone back to his former habit of eating a heavy mid-day dinner, in addition to two other hearty meals. *Post hoc*, whether *propter hoc* or not, he began to cough and raise sputum, and for several days his temperature again rose above 100° in the late afternoon, while physical examination revealed moist râles below the right apex. A return to his former strict diet was followed by a prompt improvement again, which progressed thereafter uninterruptedly.

By May 2 the patient had recovered his former appearance of robust health, and weighed 132 pounds. He has been at work since early in April. On the date mentioned he was presented at a meeting of the Atlantic County Medical Society, and examined by a number of members. At this time there was still some dulness below the right apex, with a rather harsh respiratory murmur, but no râles whatever. He reported that he had not coughed at all for three or four weeks and that he felt as well as he had ever done.

The foregoing case has seemed sufficiently important to be reported in detail, on account of the very prompt and striking effects that resulted from giving the man more air and less food than he had been receiving before. The report also embodies substantially the method of treatment, both hygienic and medicinal, that has been followed in numerous other cases of pulmonary disease which have been under my care during the past winter and spring. Reports of these are here appended :

CASE II.—A widow, forty years old, a resident of Philadelphia, and sojourning in Atlantic City for her health, was said to have had peritonitis in March, 1893, and since then to have taken morphin—her dose, when she came under my care, having been about one grain daily, hypodermatically, with a proportionate amount of atropin. She had been coughing more or less for upward of a year, and badly for about a month, after an acute attack in Philadelphia of what was considered to be congestion of the lungs threatening pneumonia. She was very thin and emaciated and exceedingly nervous. She was supposed to have had at one time spinal meningitis—probably aggravated spinal irritation. Her temperature at the time of my first visit, December 27, 1893, was 99.6° at 11.00 A.M., and subsequently ranged from 100° to 102° in the late afternoon. She had sweats at night, until they were controlled by a pill of agaricin, gr. $\frac{1}{12}$, with Dover's powder, gr. 1, one or two of which were given at bedtime. She coughed hard, especially at night, raising a moderate amount of characteristic tuberculous sputum, and occasionally vomited after eating, though with nothing like the frequency in Case I. Examination disclosed the usual signs of a small area of consolidation at the left apex, with a larger area at the right, which had begun to soften. The treatment adopted was similar in the main to that described in Case I. Morphin was gradually withdrawn, codein with nerve-tonics being substituted, and later the codein itself was withdrawn. Similar rules of diet were made as in the previous case, but could not be carried out so strictly, as the patient lived in a boarding-house in which dinner was served in the middle of the day, and the *menu* at supper afforded a scanty variety. Sweets were forbidden and moderation enjoined as to starchy articles. The net result was that the patient took

considerably less food than before, and in consequence digested it much more perfectly. She had a fairly good stomach after she began to improve, and creosote was given her in doses of from one to three drops after eating.

On January 5 there was a slight hemoptysis which was promptly controlled. By January 20 my notes show that her temperature no longer rose above 99.5° in the afternoon, and the cough had ceased entirely, not having troubled her at all for the week previous. All narcotics were now discontinued.

On January 27 there was a return of fever, the temperature rising to 101° , but without any return of the cough or expectoration. The patient had been disregarding her rules of diet and indulging in some indigestible food. Within a few days, the patient meanwhile having been kept in a recumbent position, the fever disappeared and the temperature for sometime afterward did not rise above 99° .

In this case the early and apparently entire cessation of the cough was very noteworthy, but the dulness on percussion remained, with some harshness of the respiratory murmur. Some slight moist sounds persisted long after the patient insisted that she no longer coughed or raised anything, but by the end of two months dulness and some increased vocal fremitus were the only noticeable signs over the affected areas. She had gained five pounds in weight and was less nervous.

The patient left Atlantic City for the interior of Pennsylvania on May 1, and during four or five days preceding that date she had complained of a slight cough for the first time in three months, and had occasionally raised a little sputum in the morning.

The temperature remained normal, but a few faint râles were found to have reappeared at the right apex. On May 18 a letter was received from her stating that she had developed whooping-cough of a severe type, and with this was again having fever and night-sweats, so that a serious relapse of the tuberculous trouble has evidently taken place as a result probably of the pertussis, which possibly caused the slight return of cough in the last days of April.

CASE III.—A lady, twenty-five years old, a member of a family in which there has been much tuberculosis, had always been accustomed to plain living, but last summer gave up housekeeping and boarded in a house in which the table was rather luxurious. Her digestion became somewhat impaired, and about midsummer she began complaining of a stubborn dry cough. The usual remedies had no effect, and in December last I found slight but well-marked infiltration at both apices. Her diet was restricted, though less than in the preceding two cases, as her habits were active, and the same regimen was enjoined. The cold sponge-baths and constant counter-irritation by means of iodine were particularly insisted on, and the patient, having been somewhat of a bicyclist in former years, was urged to resume that form of exercise, and keep out of doors on her wheel as much of the time as possible. She was directed to take continually creosote in doses of from one to three drops on sugar after each meal. She shortly after began to show improvement, and with but few interruptions progressed favorably until this writing, May 18. She now weighs six pounds more than at the time of beginning treatment, and no longer coughs. Her temperature, which was rising pretty regularly to 99.5° , and

sometimes to 100° in the latter part of the day, has for some time not gone above normal. The physical signs indicate an arrest of the disease at both apices.

CASE IV.—A widow, twenty-nine years old, whose husband died two years ago of pulmonary tuberculosis complicated with alcoholic gastritis, had always had good digestion, and has been fond of sweets, including candies, and not over-digestible lunches between meals. She had had a hacking cough since the time of her husband's death, and was greatly emaciated, her weight ranging between eighty and ninety pounds. A year ago, after an attack of influenza, she began to expectorate. She came under my care in February last, and I then found a small consolidated portion of lung below the right apex, as plainly shown by signs recognizable both in front and behind. There were also numerous subcrepitant râles in the same region. She had been seen by Dr. R. G. Curtin, in Philadelphia, some months before, and he had prescribed guaiacol. Her former medical attendant had continued this drug, giving no other medicine. I also directed that the guaiacol be continued in doses of from two to three drops after meals, and placed her at the same time upon a somewhat restricted diet, forbidding especially all lunches between the three regular meals, except that milk was allowed at bedtime, and cutting off rigidly all indigestible dishes.

Constant counter-irritation over the affected spot was ordered, and the patient was strictly enjoined to spend a large part of every day out of doors, except in the worst weather, and to have ample ventilation of her room at night. The clinical thermometer, the regular use of which I always insist upon in all cases of suspected tuberculosis, disclosed slight rises of temperature for some time after the patient came under my care, never, however, going

above 100° , and within a few weeks after the institution of the hygienic measures just described it ceased to rise above 99° . The expectoration also gradually diminished. At the time of my last examination, May 14, there was still dulness at the right apex, both in front and behind, with slightly increased vocal fremitus and wavy respiration, but no râles of any kind, and the patient reported that she had neither coughed nor expectorated for three or four weeks. Her weight had increased to ninety-two pounds, which is above her average for the past six years.

I consider the disease arrested in this case, but the patient is continuing the guaiacol with the still more important hygienic precautions. She now eats all that her appetite demands at the three meals, but takes no lunches except the milk at bedtime.

CASE V.—A shopkeeper, sixty-two years old, of very broad chest and robust build, weighed 220 pounds shortly before he became ill. I was called to see him on January 18, 1894, on account of a moderate hemoptysis. He had been coughing somewhat for six months or more. A small area of dulness was found a few inches below the right apex, anteriorly, and there was feeble respiration over the same region. The bleeding yielded rather slowly to treatment, and was followed by a rise in the temperature, which reached 101° at night, falling to the normal again in the morning. There began to be raised a considerable amount of sputum, which continued to be blood-streaked for a week or more. The cough became very severe, especially at night. The patient had also long suffered from intestinal indigestion, with flatulence and constipation. He was ordered a plain but substantial meal, mainly of meat, eggs, or milk, morning and night, with a light

lunch in the middle of the day; also a full pint of hot water an hour before each meal, with a view to overcoming his constipation and lessening his obesity. His chest was sponged with cold water every day, and the skin over the affected region was kept sore with iodine. Creosote was given in small doses after each meal, and on account of the unusually severe character of the cough, which prevented sleep and threatened further hemorrhage, an anodyne mixture had to be administered at night. A slight recurrence of hemoptysis at the end of a week complicated matters, but after this marked improvement set in. The temperature speedily fell to normal, cough and expectoration steadily lessened, and, what most delighted the patient, his constipation and intestinal flatulence were overcome, while his protuberant abdomen sensibly retracted. For nearly a month this improvement continued, and the patient seemed to be getting well, when he contracted a severe "cold" by standing on a street-corner engaged in conversation, after a long walk, on a cold day in March, and the congestion thus set up resulted in another hemorrhage.

From this time on hemorrhages recurred every week or two, in spite of a plentiful use of the best astringents. The infiltration finally involved the greater part of the right lung and invaded also the apex of the left. A cavity has formed in the center of the right lung, and the case is likely now to follow the usual course. After the hemorrhage began to recur with such alarming frequency the hygienic method was virtually abandoned; efforts were made to restrain the violence of the cough at all hazards, and anodyne cough-medicines had to be resorted to freely, regardless of the effect on digestion. Moreover, the family had an invincible dread of fresh air, so that all attempts to carry out the plan of

securing a freer oxygenation of the blood were nullified.

CASE VI.—A physician, thirty-six years old, had infiltration below the apex of the right lung when a medical student in Philadelphia in 1879, according to the diagnosis of Prof. J. M. Da Costa. He had fever and cough during most of the following winter, and had to abandon his studies for some time. The disease was later controlled, and he regained good health. In October, 1893, having meanwhile moved to Atlantic City, he again developed cough, with a return of the signs of consolidation of the right lung. His temperature was a little above normal nearly every afternoon until about the 1st of January, 1894, and occasionally, though rarely, reached 101° . He treated himself for the most part, but occasionally consulted me during the months of December and January. He has always had a perfect digestion and made no change in his usual full diet—three regular meals daily, with dinner at night—except that a generous allowance of milk was now substituted in part for other less nourishing foods. He continued in full practice and was riding out of doors in an open buggy during the greater part of every day, and much of the time during the evening. Vigorous counter-irritation was kept up over the affected spot, and creosote was taken to the extent of about fifteen drops daily.

Various tonics, including cod-liver oil, arsenic, and strychnin, were taken at different times. In short, the treatment was counter-irritant, antiseptic, and roborant to the fullest extent, and, what was doubtless most important of all, oxygenation was maintained at the maximum point possible without over-fatigue, by almost continual driving out of doors in a pure air. By the middle of December the signs, as well as the symptoms, indicated a rapid arrest of the disease. The patient's weight at the

beginning of the attack had fallen to 158 pounds ; it is now 186 pounds. Some dulness persists over the area formerly affected, but otherwise the patient is well. He has had no expectoration and no cough whatever for nearly three months.

In Case V a specimen of the sputum obtained at an early stage of the disease, when the cough and expectoration had almost ceased, was examined microscopically by Dr. D. Braden Kyle, of Philadelphia, and a few bacilli found. No examination of the sputum was made in the other cases, as the physical signs and symptoms were decisive and left no room for doubt as to the character of the malady in any of them.

The foregoing do not represent selected cases, but include all the cases of undoubted pulmonary tuberculosis that have been under my care for any considerable time during the past winter and spring. One serious case in the third stage which was sent by Dr. Ralph Walsh, of Washington, D. C., remained about two weeks only, as, though some little improvement occurred in appetite and digestion from the change of climate, I was unable to promise any lasting gain from a longer sojourn. A number of others in the early stages, in the persons of transient visitors, were seen a few times, most of them at my office, and, as a rule, there was more or less amelioration of the symptoms, but none of these were under methodical treatment.

The results in the six cases here described were, on the average, considerably better than I have been accustomed to see in former years, when it was not my practice to impose any restrictions upon the diet

of tuberculous patients, but rather to encourage the fullest feeding possible. Neither in my experience in Atlantic City during many years previously to the past winter, nor in Thomasville, Ga., during the winter of 1892-93, where I saw a large number of cases of tuberculosis in all stages, were the fever, cough, general nutrition and body-weight found so generally to improve under any of the methods of treatment then employed. These later results have been obtained in four out of the six cases, with the aid of so little internal medicine, and that little addressed almost entirely to the digestive tract, that the conclusion seems irresistible that the management of the diet and hygienic regimen generally should receive the chief credit. The other two cases, V and VI, are the exceptions that prove the rule. Case V had a rather poor digestion and the anodyne and astringent mixtures apparently necessitated by his cough and recurring hemorrhages exerted, without doubt, an injurious influence upon his digestive organs.

Case VI had a stomach that could digest anything, and, therefore, this patient could bear and progress favorably under a more active medication than most others.

It is doubtful whether any drugs yet discovered have a directly curative effect on tuberculous lesions, though there may be a few, including some of the preparations of the hypophosphites, that, by stimulating the circulation of blood in the lungs, aid in improving the nutrition of the diseased tissues. It is probable that the majority of drugs, as well as those changes of climate that seem to exert a favor-

able influence in pulmonary cases, effect their good results for the most part indirectly by increasing appetite, improving digestion, and stimulating the vital processes generally, thus increasing the quantity and bettering the quality of the blood that reaches the diseased structures. Indeed, we are justified now in believing that an abundance of pure healthy blood, circulating normally in the lungs, is the most essential prerequisite to a cure of pulmonary tuberculosis. Hence the paramount importance of looking closely to the blood-making processes by securing as perfect digestion as possible, together with a complete oxidation of its products, so as to spare the lungs from the injurious task of assisting in the excretion of the poisonous compounds resulting from suboxidation and decomposition. To attain these ends satisfactorily, the total amount of aliment ingested must not be in excess relatively to the amount of oxygen absorbed.

We may, therefore, safely insist upon liberal feeding whenever the patient can exercise freely out of doors in any clean aseptic air.

When, on account of fever, rest of the body is temporarily necessary, a fairly good supply of oxygen is still obtainable by causing the patient to lie on a bed or hammock out in the open air. When this is not practicable, we should have the windows of his bedroom kept widely open, resorting to extra bed-covering if required. In this way, a much larger amount of food can be taken with safety and advantage than when the patient is kept confined in an overheated room.

While insisting that the patient shall be kept out

of doors as nearly constantly as possible, and, at all events, shall always, night and day, have an abundance of fresh air to breathe, whether within doors or without, it may be noticed that I have hitherto said little about the relative value of different airs or climates for cases of the disease under consideration. The reason is that I consider the importance of selecting a special climate for such cases greatly overestimated. Certain climates are doubtless somewhat more suitable than others for diseases of the lungs, but the difference is much less than is commonly supposed. The germ-laden air of crowded cities is naturally less curative than that of the country, seashore, or mountain. The purer the air the better, and contrary to a prevalent notion, the colder the air the better, provided only the patient can and will educate himself to be out in it and breathe it freely. It is said that the only climate in the world in which pulmonary tuberculosis does not exist is that of Iceland.

It is true that changes of climate exert a powerful stimulant action upon nutrition for a few months especially. Hence persons afflicted with pulmonary disease who have means to travel can often benefit greatly by changing from the seashore to the mountains or *vice versa*, after they have ceased to improve as at first. But to send tuberculous patients with slender purses to distant resorts in the hope of finding some peculiar or magic virtues in the air of the place different from those in their own is usually as disappointing as it is cruel. Such patients as can ill afford the luxury of travel, if still in an early and curable stage, should be urged to lead an out-

door life in any locality (preferably away from large cities) where they can do so most conveniently and economically, and where the climate is not so rigorous as to prevent such a mode of life. If they are in a far advanced and hopeless stage they should be made as comfortable as possible in their own homes.

About twelve years ago a clergyman resident in Delaware came to Atlantic City with a diagnosis of pulmonary tuberculosis, made by a prominent specialist in Philadelphia, and sought my advice. It was a plain case, a large part of one lung being consolidated; but softening had not begun. At that time I had given little thought to the subject of diet in such affections, but poor parsons are not likely to be overfed. I told him to give up his pulpit for a year and go into the country, spending his time on horseback or in any way most agreeable to him, so long as he remained in the open air. He was also to keep up counter-irritation over the affected lung. He took the advice, and got well, and was able to resume his work by the end of the year. I have never seen him since, but he often sends me a box of the best Delaware peaches, accompanied by a letter full of gratitude to me for having shown him the way that led him back to health.